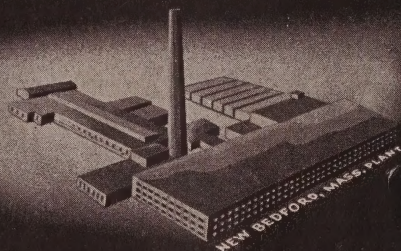
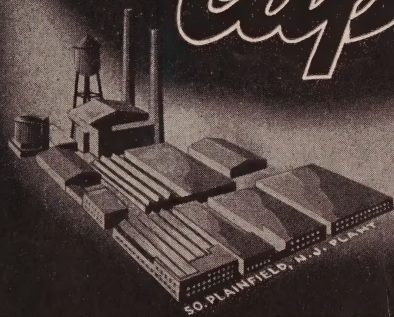


The CORNELL-DUBILIER *Capacitor*



Vol. 10

NOVEMBER, 1945

No. 11

CORNELL-DUBILIER ELECTRIC CORP.
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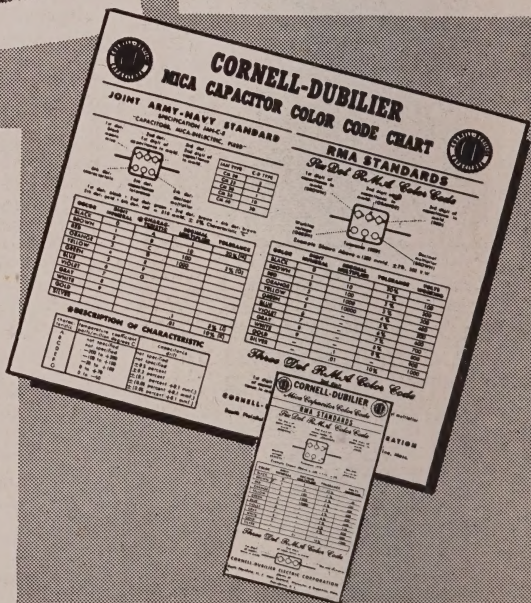
*Service
mess up sets ②*

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SERVICING MESSED-UP SETS*

PART II.

Our discussion of tampered or "messed-up" sets in the October issue of "The C-D Capacitor" was limited to tubes. This month we shall discuss results of tampering involving other components.

Cases where tampering is both gross and obvious need little comment. Probably every radioman has received sets for repair in which the set owner, or some other "expert," has replaced a resistance cord with a line cord, blowing out one or more tubes as a result. Almost as common is the use of a 400 ohm speaker to replace a 3,000 ohm unit, making still another speaker replacement necessary. We may, in passing, recommend for honorable mention in the Messers-Up Hall of Fame, the set owner who unsoldered most of the connections in his radio, and joined them back together with radio cement.

When tampering is gross, but not obvious, service is not quite as simple. To illustrate, an instance may be cited where an oscillator coupling capacitor

had been removed from a camera-type portable. Extensive voltage, resistance, and other tests were made before the radioman realized that the capacitor was missing.

Service would have been simplified if the radioman had possessed a vacuum-tube voltmeter. Grid bias measurement with this meter would have shown an abnormally low negative voltage to cathode from the oscillator grid (see Fig. 1). The next step would have been to check the coupling capacitor for a decrease in capacity, which would have resulted in quick discovery of the unit's absence.

The 1,000 ohm-per-volt meter actually used, however, gave an inaccurate contact voltage reading which was interpreted as correct merely because it was negative, and led the radioman to go on to check other circuits. This case underscores the need for a wide variety of reliable test instruments in serving messed-up receivers.

Another instance of gross, but not too obvious tampering, was found in the connection of an aerial to one side of the power line. This occurred on a set in which the external aerial is mechanically, but not electrically, connected to the line cord, and is normally left unterminated at the plug. An electrician, noticing the unconnected wire, thought it had worked itself loose from the plug, and attached it there. The result was a decrease in volume that led the owner to take his set to a more competent technician.

The radioman suspected that the antenna coil primary was defective, and shorted it to B— to see if volume was affected. The resultant fuse blow-out led to quick location of the trouble (see Fig. 2).

Intentional tampering is sometimes encountered. Here is what to look

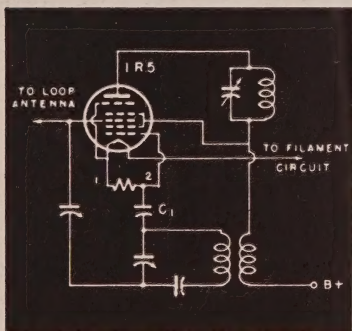


Fig. 1.—Voltage between points 1 and 2, when measured by a v-t voltmeter, would be very low if C1 was open, or missing, since C1 is in a grid-leak circuit.

* Courtesy of "Radio & Television Retailing."

for on sets that have gone through this mill:

Extreme misalignment. This is the quickest, and therefore the most usual form of sabotage.

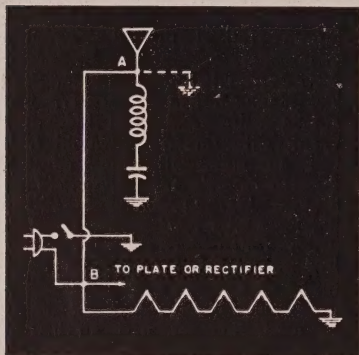


Fig. 2.—Improper connection of the aerial lead to the ungrounded side of the line became readily apparent when A was shorted to ground, resulting in fuse blow-out.

I-F coils cut through. In some cases, terminals of these damaged coils are connected with a simple wire, so that a continuity reading will be obtained. Check all coils for proper resistance values before giving any estimates on these sets, to avoid future trouble.

Intermittently defective tubes. The cleverer type of saboteur does not replace his customer's tubes with bad ones, but substitutes intermittent tubes that test perfect on the meter. Your estimate will be completely off if you don't take this possibility into account. A wise procedure is to place all of the tubes in the suspect set into a similar, repaired receiver, and check them in that way.

Damaged power transformers. In one case, the transformer smoked, and seemed to be shorted. The radio-man investigated, even though he did not suspect any tampering, because the burnt odor that generally accompanies a shorted power transformer was absent.

After a careful search, he found a filament lead from the transformer obscurely nicked, so that it shorted against the transformer shell to ground. It was a sly, well-disguised case of sabotage, perpetrated by a repairer who wanted to minimize the possibility of detection.

Going back to unintentional damage caused by incompetent service—when one or more intermittent troubles are also present in these sets, trouble-shooting may become quite difficult.

Triple Trouble

Take the case of a 3-way battery portable, which had been misaligned by its owner, and which had, in addition, two intermittent defects. One was a screen resistor that opened only when the set was right side up, and closed when the radio was turned over for testing. The other was a 1A7 that tested perfect, but became inoperative soon after the switch was turned on.

The combination was too much for one radioman. A second technician's procedure, however, enabled him to fix the set very quickly.

The defective screen resistor was a wire-wound, flexible type, and had a

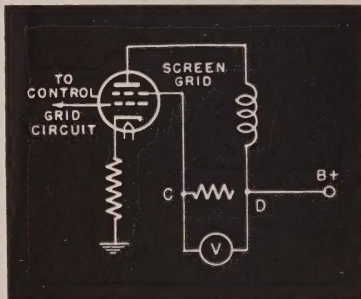


Fig. 3.—Flexible resistor C-D opened at its slack end only when set was right side up. When set was turned over for testing, the resistor had to be gently tugged after heating up, before the intermittent registered an absence of voltage between C and D.

(Continued on page 14)



A Free Market-Place for Buyers, Sellers, and Swappers.

These advertisements are listed FREE of charge to C-D readers so if there is anything you would like to buy or sell; if you wish to obtain a position or if you have a position to offer to C-D readers, just send in your ad.

These columns are open only to those who have a legitimate, WANTED, SELL or SWAP proposition to offer. The Cornell-Dubilier Electric Corp. reserves the right to edit advertisements submitted, and to refuse to run any which may be considered unsuitable. We shall endeavor to restrict the ads to legitimate offers but cannot assume any responsibility for the transactions involved.

Please limit your ad to a maximum of 40 words, including name and address. Advertisements will be run as promptly as space limitations permit.

WANTED—Western Electric or RCA condenser microphone, portable typewriter. Will swap test equipment. Frank Dane, 3852 Eagle St., San Diego, 3, California.

FOR SALE—Majestic chassis and spks. Models 300, 130, 50, 320, 90B. Philco chassis and spkrs., Models 111, 96, 78, 76. Brunswick, Fada, Kolster radio chassis and spkrs. Kolster K-5 power amplifier and large dynamic spkr., brand new. Louis A. Goldstone, 1279 Sheridan Ave., Bronx 56, New York, N. Y.

WANTED—A good second-hand chamalyst having a VOM. Bro. Roger, S.C., Thibodaux College, Thibodaux, La.

WANT—Micro and milliammeter, also all Rider's manuals. State price and condition. A. E. Miller, 221 N. 18th Ave., Yakima, Wash.

WANTED—Contact mike for guitar and musical instrument; 16mm projector and camera. Will trade or sell 15-18w. amplifier, small transmitter, typewriter, elec. fans, motors, saws, radio parts, also cash. John Arnold, P. O. Box 84, Bluffs, Ill.

WANTED—Course or books on watchmaking tools, etc. Riders 10-13, Radio text books. Trade field glasses, 35 mm camera, rifle scope, books, or cash. W. J. Closson, 295 8th Street, Troy, N. Y.

FOR SALE—32v. dc-110 v. ac, 200 watt converter, filtered, public address system, has 2 250, 2 281, 2 26 and 1 27 tubes. Will push two Fox units. Made by Cash-Hughes. George Johnson, 28932 Cambridge, Garden City, Mich.

FOR SALE—Beam power 12 v. filament radio tube SC 1632, good for many substitutes, \$1.00 each. Lewis, Room 702, 54 W. Illinois St., Chicago, Ill.

SALE OR TRADE—Several items in testing equipment, books, manuals, also Underwood typewriter, French Colemont binoculars, clippers, etc., send for list. Want Hammarlund Super Pro or similar sw receiver, condition not important, others considered. Glenn Watt, Chanute, Kansas.

FOR SALE — RCA Victor, mod. 26x1, 6 tubes, ac-dc. 2 bands, 535-1720 kc and 8700-15600 kc, \$32.50, good condition. W. O'Brien, 266 W. 4th, Fulton, N. Y.

CONTACT me for radio parts, tubes, etc. Also have some small radios for sale. All letters and cards answered. W. O'Brien, 266 W. 4th, Fulton, N. Y.

FOR SALE—Tubes, mostly Philco, in sealed cartons, at list prices. Send for list. Herbert Levinson, 2422 N. Natrona St., Philadelphia 32, Pa.

WILL SWAP—Precision Multi-meter, series 856, practically new condition for Precision series E-200 signal generator in similar condition. J. F. Intiso, 1837 Hunt Ave., New York 60, N. Y.

FOR SALE—Nearly new Radio City Products Co. tube tester, mod. 308. Best price takes it. Grillo Radio Shop, 58 Forest St., Milford, Mass.

WANTED — Radio test equipment; Rider Manuals, will pay cash. John J. Levine, 17 Kelly Square, Worcester 4, Mass.

FOR SALE—Pocket size Bernard ac-dc multimeter, 1000 ohms per volt, uses 3" square type meter. Unit in perfect operating condition, \$15.00. Jack Goldstein, 151-09 34th Ave., Flushing, L. I., N. Y.

WANTED—Riders Manuals, will pay cash. For Sale—Jensen theatre speaker, one genemotor, one Racon trumpet, two giant Racon units. Carr Electric Products Co., 17 Kelly Sq., Worcester 4, Mass.

FOR SALE—3 stage ECO and crystal 100 watt output transmitter, HK54 output complete with power supply, antenna tuning panel, all rack mounted. Sell complete or separate, at less than cost of parts. Herman Yellin, 351 New Lots Ave., Brooklyn 7, New York.

METERS—I need lots of 3, 5, or 6 v. meters, and 6 v. bell buzzers, the cheap type. Send types you have and price in first letter, also 2, 3, 4 in. speakers. Have \$100 worth radio parts to sell or swap. F. A. Cabon, 6017 Sunset Blvd., Los Angeles 28, Calif.

WANTED—Stancor master de luxe, mod. 133, heavy duty auto and radio service pack, or model 132, 125, all radio packs. L. C. Chapman, Rt. 1, Columbus, Miss.

WANTED—Channel analyzer, cap meter, sig. gen., VOM and VTVM, tube tester and Riders Vol. 7 to 14, must be in A1 condition. State price and describe in first letter. G. Brokaw, Rt. 4, Box 544, Stockton, Calif.

FOR SALE OR TRADE—1 RCA communication receiver, mod. AR-77, one 10-tube FM receiver, 3 Astatic xtal pickups, mods. S8, S12, new, three-quarter size bass violin. Wanted—A good recorder, 30w amp., or transmitter. Gerald Hess Radio Service, Moravia, New York.

FOR SALE—Underwood No. 5 typewriter, recently overhauled, \$50; will take some critical tubes on deal. New RCA portable radio 94BP-1 \$25, less batteries. New guaranteed unopened tubes at list. Will trade new tubes. Goodwin Radio Shop, Rankin, Illinois.

FOR SALE—Eight used RCA 800 and several WE 242C tubes. Make offer. One new RK-47, new price, no priority. Edwin L. Robb, c/o WAOV, Vincennes, Indiana.

FOR SALE—Emerson batt. set, table mod. takes 2 45 B bat., 1 1½ v. A bat., \$17 post paid. All types radio tubes in stock. Snyder's Radio Service, P O Box 321, Sunbury, Pa.

WANTED—Set of Rider's Manuals, Thos. Fenimore, 201 York St., Burlington, N. J.

FOR SALE—Two speakers, nearly new 8" Rola, mod. K 8, 1000 ohms. Best price takes them. Grillo Radio Shop, Milford, Mass.

FOR SALE OR TRADE — Warner Brush electroplater, battery type, with battery. one 3 oz. jar copper electroplating compound, jar of nickel-silver, 2 3 oz jars pure 24 karat gold and instruction book. \$25, or what have you. Alex Poch, Box 174, Dillonvale, Ohio.

FOR SALE—Mod. 589 Supreme tube tester, brand new, \$39.50, half cash, balance C.O.D. Xavier Curio, 1729 Victor St., Bronx 60, N. Y.

FOR SALE—Janette rotary converter, 32 v. dc to 110 ac, 150 watt, like new. Junior executive 2 way inner communication call systems, brand new; Philco HR-1, new recorder, with mike, for Philco 1941 radio combination. Clough Brengle audio oscillator, mod. 79c, perfect. Earl H. Stevens, Rt. 1, Bourbonnais, Ill.

WANTED TO BUY — Schematic diagram and operating data for Radio City tube tester, model 800. Will pay any price. Gregory's Radio Shop, 3648 Bailey Ave., Cleveland 13, Ohio.

FOR SALE — NRI code teaching outfit. Complete except for last lesson, one tape slightly damaged, otherwise in A1 condition. Make Offer. Radio Repair Service, PO Box 15, Lebanon, Pa.

FOR SALE—Remote tuner for any broadcast receiver and Keystone f 2.9, mod. A-7, 16 mm movie camera, make offer. Wanted 35 mm. or 2¼"x3¼" camera and flash attachments, also 16 mm. projector. I. Zambakian, 347 Belleville Ave., Bloomfield, N. J.

FOR SALE—Genemotor, 6v. input, 300 v. output dc, Hollywood motion picture sound projectionist course, 20 lessons, best offer. Len Cross, 1002 Tourmaline, San Diego 9, California.

WANTED — One 12B8-G vacuum tube, needed for use in invalids bedside set. S. R. Manning, 1365 Cass Ave., Detroit 26, Michigan.

(Continued on page 14)

**DISPLAY RELIABLE RADIO
SERVICE PLACARD IN
YOUR SHOP!**

**Available at your local jobber.
See Page 2.**

F-M DISCRIMINATORS*

The discriminator stage of the f-m receiver serves the identical purpose of the detector in the a-m receiver. Both are used to recover the audio intelligence from the r-f carrier. However,

the similarity ends there, the characteristics and operation of either detector being dependent on the wave shape of the transmitted signal.

To properly understand the opera-

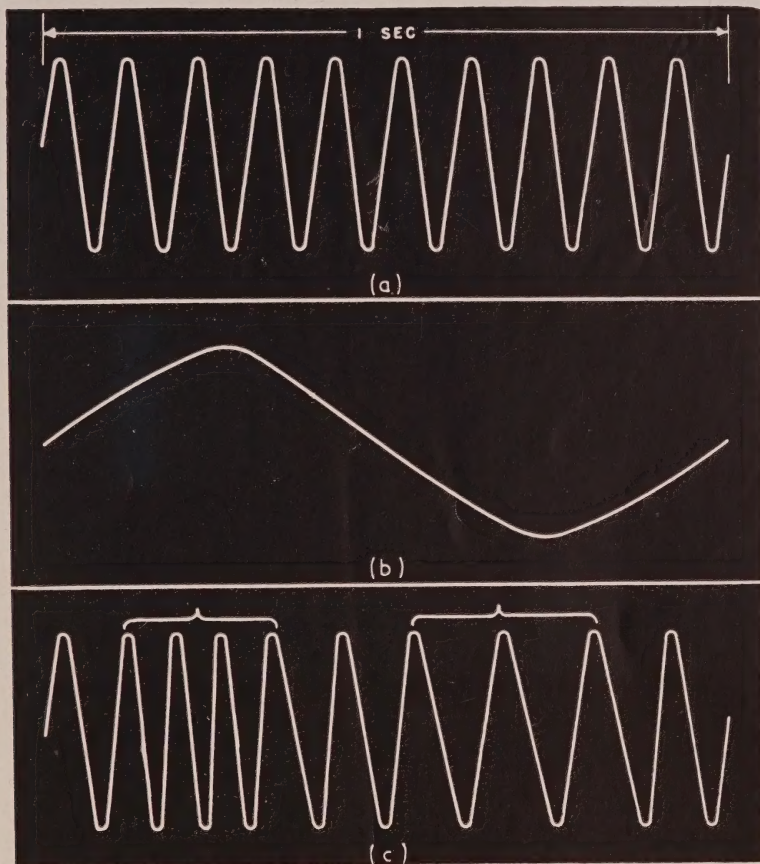


Fig. 1a represents 10 cycles of a 10-cps wave; 1b shows a 1-cps modulation wave; 1c is the resultant wave form when the two are combined in f-m. Note variation in individual wave form.

* By J. George Stewart in "Service" magazine.

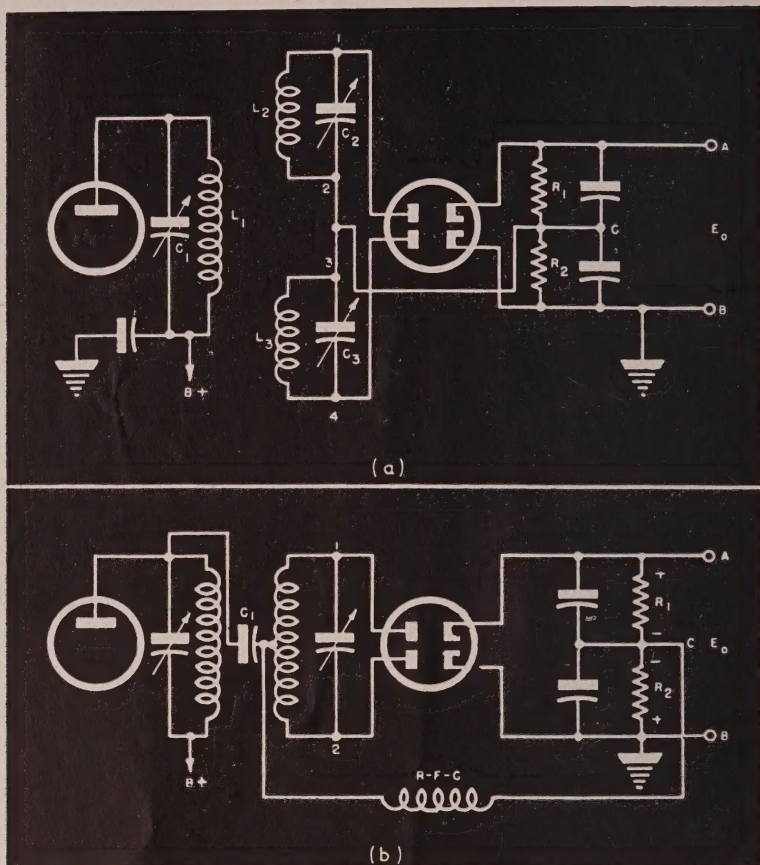


Fig. 2a and b . . . Here are two types of discriminator circuits. Circuit of Fig. 2b is used in most f-m receivers.

tion, alignment, and servicing of discriminators, it is first necessary to understand the form of the transmitted carrier and its characteristics at the time of application to the discriminator.

Let us consider a sine wave of 10 cps, Fig. 1a. This sine wave is to be frequency modulated by a sine wave of 1 cps, Fig. 1b. The 10-cps carrier

must respond to two characteristics of the modulating 1-cps wave, its frequency and its amplitude. Now let us assume that it is desired to change the frequency of the carrier 5 cycles, when the amplitude of the 1-cps wave is 10 volts. If the action of the circuit could be made linear, a 1-cps wave of 5 volts would then change the carrier frequency $2\frac{1}{2}$ cycles, etc. We could then

state that the frequency deviation of the carrier is a function of the amplitude of the modulating signal.

However, the frequency of the modulating wave must also be considered. In order to affect the carrier with the frequency of the modulating signal, we could take the change in carrier frequency and cause it to occur at a rate

depending on the frequency of the modulating signal.

For example, suppose the 10-cps carrier is to be modulated by a 1-cps wave whose amplitude is 10 volts. By the standards set up in the previous paragraph, the carrier should vary from 10 cps to 5 cps to 10 cps to 15 cps and back to 10 cps in the space of

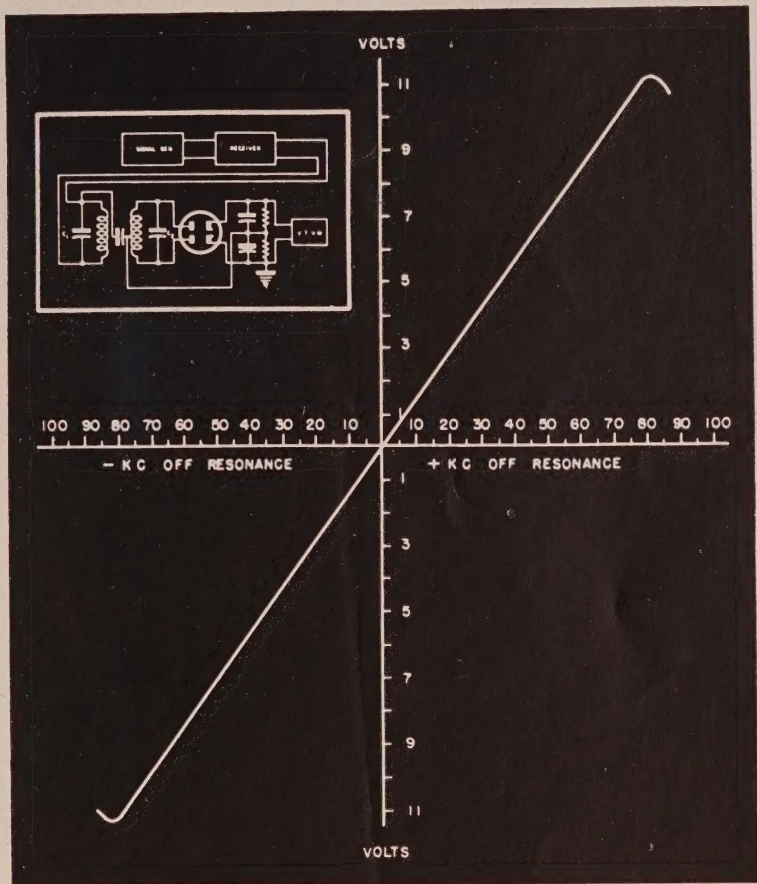


Fig. 3.—A typical response curve for the circuit shown in the insert. Developed voltage is a function of off-resonance frequency within the limits of broadcast f-m.

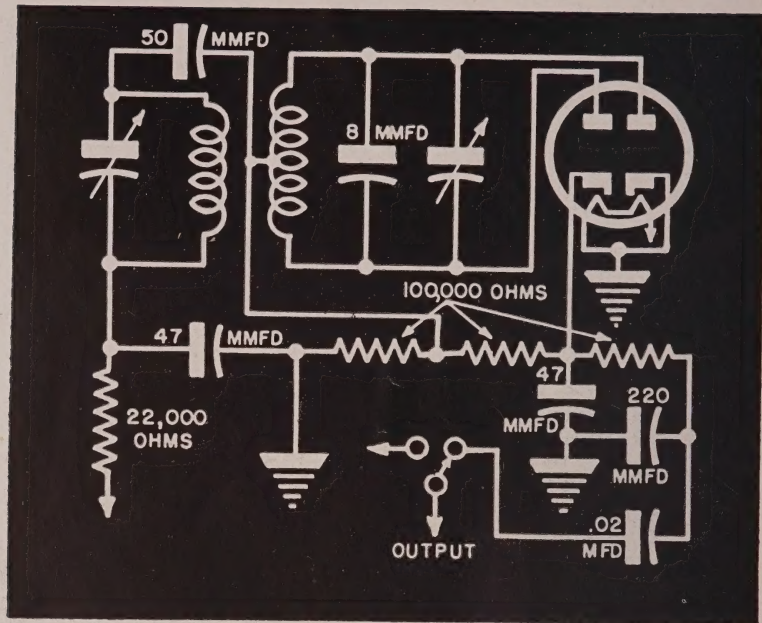


Fig. 4.—G. E. J FM discriminator. A temperature-compensated condenser is used in parallel with the secondary trimmer for frequency stability.

one second. In this manner the carrier would then contain the two characteristics of the modulating signal, its frequency and its amplitude; resultant wave is shown in Fig. 1c.

The standard for f-m transmission is a 150-kc carrier swing (± 75 kc). The full 75-kc swing represents the equivalent of 100% modulation. The frequency with which this swing, or degree of swing, occurs, is a function of the modulation frequency. For this reason a 15-kc modulation wave is as easily transmitted as a 100-cycle wave.

In the f-m receiver, all stages ahead of the discriminator are used to amplify the received signal, in the same manner as the r-f section of an a-m receiver. There is an additional feature in the f-m receiver. This is the limiter. Since any variation in the amplitude of the received signal serves no

useful purpose (in fact this variation is actually detrimental to the action of the discriminator), the limiter acts as a source of constant voltage to the discriminator, even though the input to the limiter itself varies. It is identical in action to a voltage regulator.

Two types of discriminators are in popular use; Fig. 2, a and b. Both circuits perform the same function, to demodulate the f-m signal in terms of audio frequency and amplitude.

In Fig. 2a, $L_1 C_1$ is tuned to the i-f frequency, say 4,000 kc. $L_2 C_2$ is tuned to 4,075 kc, and $L_3 C_3$ to 3,925 kc. When a signal voltage of intermediate frequency appears across $L_1 C_1$, voltages will appear across both $L_2 C_2$ and $L_3 C_3$ even though they are not tuned to 4,000 kc. This occurs because of the proximity of their resonant frequencies to that of the i-f, or center

frequency. Since the frequency deviation is identical in both directions, the voltages across the two secondaries will be equal. In addition, the polarity of points 1 and 4 will be identical. When these voltages are positive the diodes will conduct, and direct voltage will appear across R_1 and R_2 . However, since both points A and B are positive with relation to point C, these voltages will cancel, and the net voltage between points A and B will be zero.

When the frequency in the primary of the transformer shifts to 4,075 kc, which is the resonant frequency of $L_2 C_2$, a higher voltage will be induced

across points 1 and 2, and a lower voltage across 3 and 4 (since the deviation from the $L_2 C_2$ resonant frequency is greater). When conduction takes place on the positive peaks, the voltage across R_1 will be greater than that across R_2 , which has dropped. The difference voltage will then appear across A and B. When the frequency shifts to 3,925 kc, we have the same condition, but in reverse. Therefore the amplitude of the voltage across A and B will be a function of the frequency swing of the intermediate frequency, and the audio frequency will depend on the frequency with which this swing occurs.

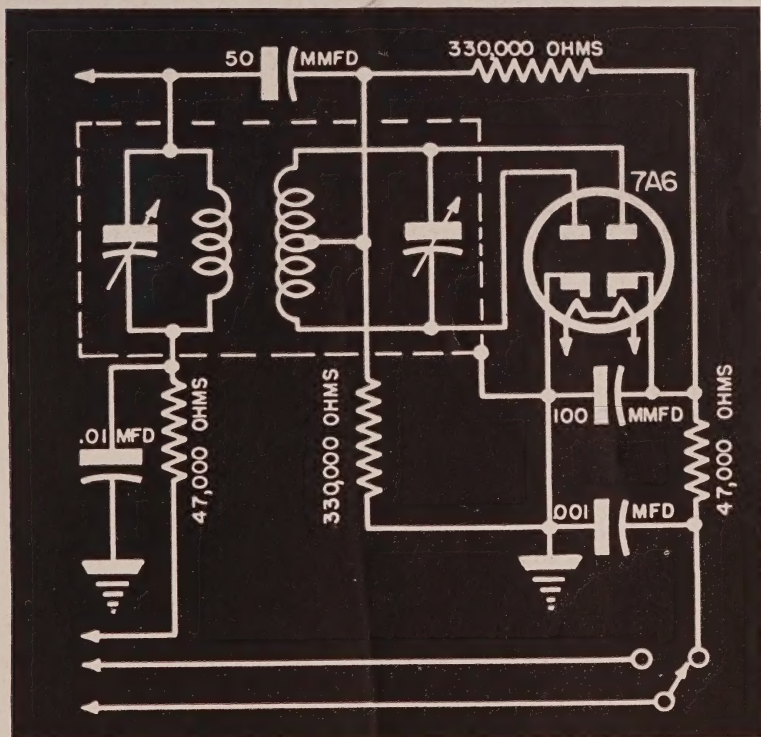


Fig. 5.—Pilot 300 discriminator. This circuit is similar to the G.E. circuit. The 47,000-ohm resistor and .001-mfd condenser are used to filter the r-f in the audio feed line.

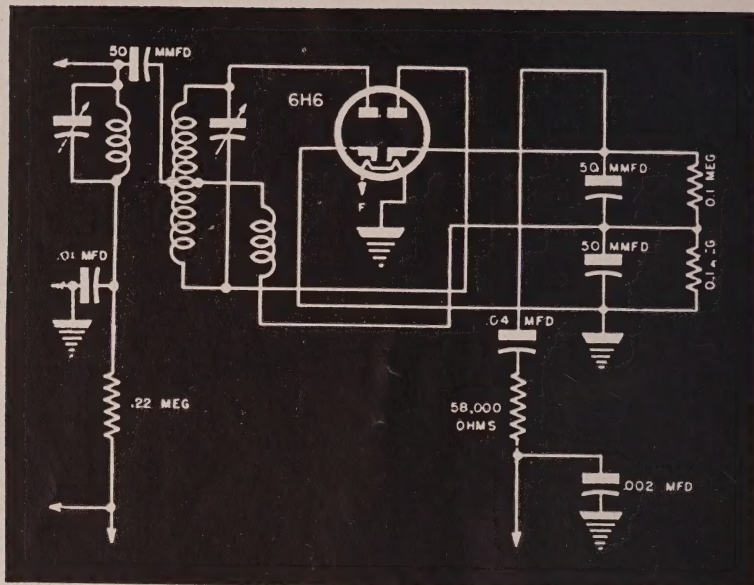


Fig. 6.—Stromberg-Carlson 25 discriminator. The choke in series with the secondary tap is used to reduce the loading effect of the two .1-megohm resistors on the transformer secondary.

The system shown in Fig 2b is the more popular of the two. Here again, at center frequency, the voltages from points 1 and 2 to ground are equal and identical in polarity. When the frequency of the i-f signal is reduced, the voltage from point 2 to ground will rise and that from point 1 to ground will decrease. Since both voltages have the same polarity, only the difference voltage will appear across A and B. A similar condition occurs when the i-f signal swings upward in frequency, but now the polarity of the voltage across A and B is reversed.

Alignment of the discriminator is simple. In Fig. 3 (insert diagram), the i-f voltage is applied to the mixer grid, and C_2 is adjusted for zero voltage across A and B, as measured on a vtvm. The frequency of the signal generator is then varied ± 75 kc. The voltage as measured on the vtvm

should be equal and opposite in polarity for both conditions. If these voltages are not equal, C_1 must be reset. A check should then be made again at center frequency to insure zero voltage. A typical graph for a discriminator, displaying ideal characteristics, also appears in Fig. 3.

Several additional precautions must be observed. A polystyrene adjustment screwdriver should be used for alignment, particularly for C_2 , since both sides of this condenser are at r-f potential.

The 6H6, 7A6, or whatever tube is used for the discriminator, should be checked for identical characteristics for both diodes, since any variation in diode response will affect the linearity of the discriminator curve.

Sufficient signal must be fed from the signal generator to the mixer grid to insure proper limiter action. Too

low a signal will result in improper alignment.

The adjustment of C_2 is critical and the series of steps previously outlined for alignment may have to be repeated several times before proper alignment is achieved.

G.E. J FM90

Figs 4 to 7 show some representative discriminator circuits as used in standard receivers. Fig. 4 is the discriminator used in the G. E. J FM90. Two points are worthy of note. A temperature - compensated capacitance, in parallel with the trimmer, serves to tune the secondary of the discriminator transformer. This is done to prevent frequency drift in the discriminator which may result in detector unbalance. A high-frequency tone filter is used to remove any residual r-f and to deaccentuate the highs.

Pilot 300

In Fig. 5 appears the discriminator circuit used in the Pilot model 300. It is identical to the G. E. type except for the tube.

Stromberg-Carlson 925

The Stromberg-Carlson discriminator used in their model 925 is shown in Fig. 6. An r-f choke is used in the return of the secondary center tap to reduce the loading effect of the cathode resistors on the discriminator secondary, thereby improving its characteristics.

Zenith 12H678

The discriminator used in the Zenith 12H678 (chassis 12A6) is shown in Fig. 7. An iron core is used in the secondary of the discriminator for alignment. The RC network in the lower right-hand corner is an a-f com-

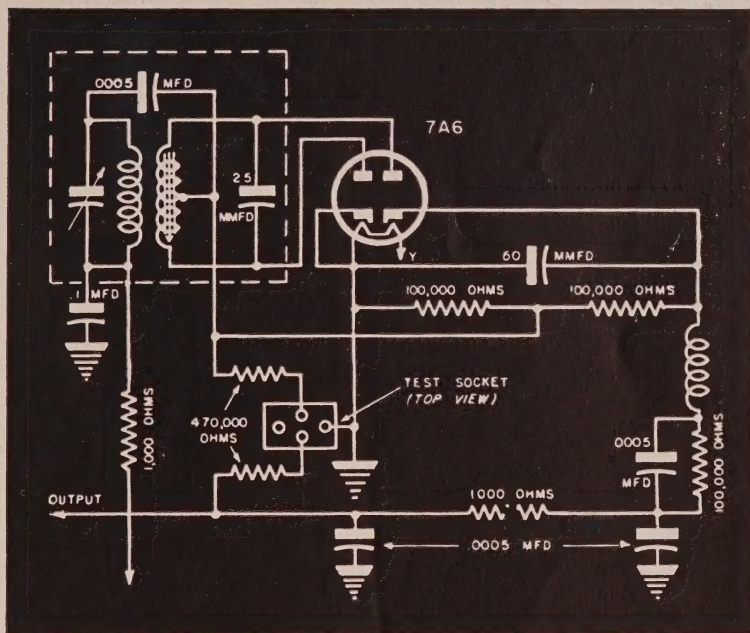


Fig. 7.—Zenith 12H678 discriminator. A socket is provided on the chassis to permit insertion of instruments for discriminator alignment.

pensation circuit for uniform frequency response. A special socket is included on the chassis to permit quick checking of the discriminator with a vtvm.

Usual Service Troubles

Service troubles in the discriminator are usually limited to poor audio response. This is caused by unbalance of the d-c voltages developed across the diode-cathode resistors. If the diode-cathode bypass capacitor is open, the d-c voltage across either cathode resistor will be found to be quite low.

In any event, realignment of the discriminator will usually result in improved performance.

SERVICING MESSED-UP SETS

(Continued from page 4)

slack, unwound section of wire at one terminal. When the set was overturned the weight of the resistor caused it to open at this end. The second technician was immediately suspicious of this resistor because the loose wire looked weak. Placing his voltmeter test prods from screen to B+ (see Fig. 3), he tugged gently at the resistor, waited for it to heat up, then tugged at it again. On the second trial, an intermittent reading occurred on the voltmeter. Replacement of the unit followed.

The first repairman, on the other hand, tested the resistor once, assumed it was ok, then went on to other tests. He lacked the imagination, or perhaps the suspicious nature, of the second technician, who took nothing for granted.

The second repairman also replaced the 1A7 at the very outset with a new one—for test purposes—because 1A7s are notorious producers of intermittents, and he was determined to eliminate any suspicious components at the very beginning. Correction of the misalignment was the only service job that remained, and that was fairly simple. When the original 1A7 was replaced, its faultiness became quickly evident now that the other troubles had been cleared up, and the new 1A7 tube was permanently installed.

(To be continued)

THE RADIO TRADING POST

(Continued from page 6)

FOR SALE OR SWAP—30 watt Operadio portable sound system with 12" speakers, velocity mike, in split case, value \$200. Need sig. generators, RF and AF, signal tracer, tube checker. Montross Sound, 3333 6th Ave., Troy, N. Y.

WANTED—Riders Manuals, 1 to 14 incl. or will buy single copies 8 to 14, need VT voltmeter, sig. gen, RCA chanalyst, and good tube tester. McCormick Radio Service, 503 Adams, Johnston City, Illinois.

FOR SALE—Dunlap heavy duty bench saw, \$25.00; Dunlap 4" jointer-planer, \$20. Both machines A1 condition. Write for details to Clyde W. Wimer, 800 Wampum Ave., Ellwood City, Pa.

SELL OR SWAP—Webster portable PA, 15 watts, with two speakers and floor stand, Shure Xtal mike, provision for extra PM speakers. WANT 5" Dumont Scope. C. L. Lawrence, Rodman Road, Framingham, Mass.

FOR SALE — Federal enlarger No. 219, Kodak No. 1, folding camera, safelight, Haynes MCM photometer, combination rangefinder and exposure meter, synchronizing flash unit, 2 developing tanks and numerous other photo supplies, \$50. Want signal gen. Ernest Kumiert, 21 Walker St., New London, Conn.

FOR SALE—1/5 HP motor, Delco, 110v dc, like new. Make offer. Edw. C. King, Jr., 129 East Marie St., Hicksville, N. Y.

FOR SALE — G-E combination turntable, pick-up and auto record changer in cabinet, plus 7 albums records; 10 to 20 watt Mills studio amplifier (6 or 7 stages amplification, vol. exp., 6L6's output) and heavy duty 12" spkr. High bid. H. Dramer, ARM 1/c, 8-C Radio, Corry Field, Pensacola, Fla.

WANTED—Rider's Manuals from 1 to 5. Must be in good condition. Will pay cash. Sullivan's Radio Service, 30 East 2nd St., Duluth, Minn.

WANTED—25 shells for Colt .45 automatic. Colt new service revolver, .38 special, 6" barrel, square stocks, no junk. Harold Buckley, 1337 Marlowe Ave., Indianapolis 2, Ind.

WANTED—Riders, vols. 11, 12, 13. Please state condition and price. J. P. Adrosko, 914 Lafayette St., Elizabeth 4, N. J.

WANTED—4" joiner, small bench band saw, small bench drill press, 1/4". Give details, price, first letter. Thomas J. Mayes, Ironton, Mo.

FOR SALE—Two used Philco auto radios and one used 8 tube Arvin, \$25 each. 2 1/4 HP motors, \$14 each. One .25 calibre automatic, \$15. Paul Capito, 637 W. 21 St., Erie, Pa.

FOR SALE—15 6L6, 80c; 14 6N7, 75c; 12 5T4, 80c; 10 6K8, 65c; 25 6SN7GT, 50c. All tubes new, not boxed. Bargain price for lot. Fred Humphrey, 117 N. 20th Street, Philadelphia 3, Pa.

FOR SALE—Vacuum tube voltmeter. Up to 600 v. dc in four ranges. Also reads ac. Used, but in perfect working condition; complete with new tubes. Send \$9.50 cash or money order. John S. Jackson, 166 North Sierra Bonita, Pasadena 4, California.

FOR SALE—18" square panel meter. Checks dc v. to 600; dc ma to 300; ac v. to 800; ac ma to 200; ohms to 20 meg. Cap. 1/2 mfd. and 5/25.120, 60 cycle line. Employs 2 5" Hickok meters. \$35, cost \$120 when new. Ernest Kumfert, 21 Walker St., New London, Conn.

FOR SALE—Complete radio and refrigerator sales and service business and building. Good stock and business, owner retiring. Must sell at once, cheap. Write for details. Leo L. Bowman, 615 W. Main St., Lewistown, Montana.

FOR SALE—Volume controls, Allen Bradley type J, 10c each. Relays, dpdt silver contacts 24 v. dc can be rewound for 110 v., 95c each. Diamond Electric Co., 7320 So. Broadway, Los Angeles 3, Calif.

WANTED—Record-changer, either with radio or own amplifier. Need 70L7, 50L6, 25Z6, 12SA7 tubes. Will trade other tubes or pay cash. V. H. Hein, 418 Gregory St., Rockford, Illinois.

FOR SALE—Supreme electronic voltmeter, mod. 549, complete with instruction book and leads. Little used, \$35.00. L. R. Battersby, 206 Branch Ave., Red Bank, New Jersey.

WANTED—Circuit to a Hickok model 147 tube tester. Will pay \$1.00 for same. Supreme Radio Service, 2620 Tracy Ave., Kansas City 8, Mo.

FOR SALE—Solar model CC-1-60 capacitor checker in brand new condition, with leads and charts, \$30 f.o.b. Also Superior, mod. 1280 tube tester and VOM, A1 shape, all tubes to 117 volts. With leads and charts, \$20 f.o.b. A. Brindley, 2821 Girard Ave., Philadelphia 30, Pa.

FOR SALE—Latest Weston tube checker, 777, brand new, checks all tubes, all voltages. H. Gursh, 1481 Shakespeare Ave., New York 52, N. Y.

WANTED—Five tube battery radio, 1 1/2 v. type, several bands, with or without cabinet, with tubes or otherwise. State warranty. L. C. Chapman, Rt. 1, Columbus, Miss.

FOR SALE — DC motor generator, Elec. Spec. Co., type F-22, 1750 rpm, 220 v., 9.5 amp.—2,000 v. 0.5 amp., cast iron base included, C-H starter and enclosed switch, FOB, Cambridge, Mass. John Weare, 457 West 57th Street, New York 19, N. Y.

WANTED — Old used radio equipment: eliminators, high power transformers, tubes, repair parts. For Sale, bargains in radio tubes, parts, supplies. Radio-Electric Labs., 715 N. 7th St., Lake City, Minn.

FOR SALE—2 Racon dynamic super giant units, Ampion master dynamic unit, 6 ft. curled exponential horn, RCA 14" wide range speaker, heavy duty. J. J. Bressler, 211 West 12th St., New York, N. Y. Phone Chelsea 3-8070.

WANTED—Model 077 signal generator and model 010 condenser tester. State price and condition. Cpl. Fred Centanni, Sqdn. B, Gore Field, Great Falls, Mont.

FOR SALE—Teleplex with built-in oscillator; 7Y4, 7B7, 7C7, and other types; 3 Coto Xmttr coils, 160 meter, new; 15 in. Jensen spkr., with rectifier for field. new and used radio books and mags. Bernard Smith, 920 So. Euclid, Pasadena 5, Calif.

FOR SALE — Rider's Manuals 6 and 7, \$6.50 and \$9.00; complete vibrator power supply, \$10; 4 new non-synchronous vibrators, \$10; 1 new syn. vibrator, \$3.50; Supreme analyzer, \$25; Sterling's "The Radio Manual," \$4.00. Mrs. Oliver Martin, Jr., Croghan, New York.

SALE OR SWAP—Collins 32 B radio transmitter, AT cut crystals, transmitting tubes, floor model console Philco all-wave remote control, Rolleiflex f 2.8 Zeiss-Tessar lens camera, Sheffield old silver plate. Want good communications receiver, kw transmr. Geo. Pasquale, 601 Bashford Lane, Alexandria, Va.

FOR SALE OR TRADE — DeForest radio course, over 90 lessons, radio and television. Need communications receiver, Hallicrafter preferred. George B. Martin, Box 111, Campbell Hall, N. Y.

WILL SELL—W-E 5" scopes with 5BP4 white television tube. Extra heavy duty transformers, chokes, etc. Good foundation unit for television receiver. With 12 tubes and carrying case. Tested and demonstrated. \$50. Island Instrument Co., 368 Willis Ave., Mineola, N. Y.



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